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EXISTENCE OF THE SOLUTION TO THE CAUCHY PROBLEM FOR NONLINEAR STOCHASTIC PARTIAL DIFFERENTIAL-DIFFERENCE EQUATIONS OF NEUTRAL TYPE

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Abstract. *The authors consider the existence of the solution to the Cauchy problem in the class of nonlinear stochastic partial differential-difference equations of neutral type, with regard for random external perturbations independent of the Wiener process. Sufficient conditions are obtained for the coefficients of the nonlinear stochastic differential-difference equations of neutral type that guarantee the existence of the solution with probability one.*

Keywords: *stochastic partial differential equations of neutral type, existence of the solution with probability one, Cauchy problem.*

INTRODUCTION

Existence and uniqueness of the solution of stochastic differential equations with some initial and boundary conditions in different functional spaces, in particular, partial differential equations, has been studied by many authors [1–7]. Theorem on the existence and uniqueness of the solution to the Cauchy problem for the stochastic differential reaction–diffusion equation of neutral type was obtained in [8, 9]. We will consider here the existence of the solution to the Cauchy problem in the class of nonlinear diffusion stochastic partial differential-difference equations of neutral type with regard for random external perturbations independent of the Wiener process, and will continue the studies begun in [8–10].

PROBLEM STATEMENT

Let on a probabilistic basis $(\Omega, F, \{F_t, t \geq t_0, 0\}, \mathbf{P})$ there be given a nonlinear diffusion stochastic partial differential-difference equation of neutral type (NDSPDDENT) subject to random external perturbations independent of the Wiener process,

$$d\left(u(t,x)+\int_{\mathbf{R}^r} b(t,x,y)u(t-\tau, y)\,dy\right)=\sum_{j=1}^{r}\frac{\partial^2 u(t,x)}{\partial x_j^2}$$

$$+\sigma(t, u(t-\tau, x))dw(t,x)+\int_{\mathbf{Z}} c(t, u(t\quad \tau, x), z)\tilde{\nu}\ \ dz\ \ d(t\ \ ,\ \ \ ) \tag{1}$$

for $t \in (0, T]$, $x \in \mathbf{R}^r$ under the initial data

$$u(t,x)=\psi(t,x)\quad \forall t \in [-\tau, 0], \tag{2}$$

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